

Remarks

Claims 16–46 are pending in the application. Claims 21, 23, 24, 35 and 38 are withdrawn from consideration, and claims 16–20, 22, 25–34, 36, 37 and 39–46 have been rejected. Applicants respectfully request reconsideration of the claims.

I. Species Election

Applicants disagree with the Examiner's statements with respect to the species election requirement. Nonetheless, since the withdrawn claims depend from allowable independent claims, the withdrawn species should be examined in the present application. ReinstateMENT of the withdrawn claims is respectfully requested upon allowance of a generic claim.

II. Rejections Under 35 U.S.C. § 112

Claims 16–20, 22, 29–34, 36 and 37–46 are rejected as allegedly not complying with one or more requirements of 35 U.S.C. § 112. Applicants traverse each rejection under 35 U.S.C. § 112 as set forth below.

A. Alleged Lack of Enablement

Claims 16–20, 22, 29–34, 36 and 37–46 are rejected under 35 U.S.C. § 112, first paragraph, as allegedly failing to comply with the enablement requirement. Applicants traverse these rejections and request that they be withdrawn.

The Office action incorrectly asserts with respect to claim 16 that "[t]here is neither an adequate description nor enabling disclosure as to how and in what manner one can identify that a neutron has been backscattered by hydrogen and not by other elements in the target."

However, this matter is described in the specification (see, e.g., page 13, lines 7–29). The specification explicitly describes that neutrons are backscattered by hydrogen on a different time scale as compared to heavier elements. This is because hydrogen and neutrons have similar masses. Scattering events with hydrogen slow or "thermalize" a neutron. Moreover, due to their similar masses, a single scattering event with hydrogen is insufficient to directly backscatter a neutron. Instead, for a neutron to backscatter from a target the neutron must undergo multiple scattering events. Therefore, neutrons scattered by hydrogen are slowed and undergo multiple scattering events before being backscattered to a detector. Therefore, detection of hydrogen-scattered neutrons occurs after neutrons scattered by heavier elements, such as oxygen. Thus, the specification clearly describes the subject matter to be patented in compliance with 35 U.S.C. § 112. M.P.E.P. § 2164.04.

The Office action alleges that as to claims 16 and 29 the term "a portion of said stream of fast neutrons" is not adequately described or enabled by the application. Applicants disagree. The relevant portion is described throughout applicants' specification, for example on page 5, lines 7–28. As described above, neutrons backscattered by hydrogen are backscattered after a longer time than those backscattered by heavier elements. Thus, as recited in claims 16 and 29, neutrons are detected after a time delay. Moreover, as described in applicants' specification, neutrons are detected in a time window, which determines the portion of the neutron stream detected. *See*, specification page 5, lines 25–29. Because the full scope of the claim term is supported by the specification it is not necessary to recite a specific percentage of neutrons measured.

The Office action further asserts that the positioning of the neutron sensor and shield as recited in claim 29 is not adequately described or enabled. The claim, especially in view of the

specification, indicates that the sensor is not positioned to cause backscattering of neutrons, but rather is positioned to detect backscattered neutrons. To clarify this point for the Examiner, applicants have amended claim 29 to further emphasize that the sensor is placed so as to be contacted by backscattered neutrons.

Applicants respectfully request that the rejections of claims 16–20, 22, 29–34, 36 and 37–46 under 35 U.S.C. § 112, first paragraph, be withdrawn.

B. Alleged Indefiniteness

Claims 16–20, 22, 25–34, 36, 37 and 39–46 are rejected under 35 U.S.C. § 112, second paragraph as allegedly being indefinite. Applicants traverse this rejection and request that it be withdrawn.

The Office action alleges that claims 16 and 29 are indefinite with regard to the feature "a portion of said stream of fast neutrons" and specifically alleges that it is not known what is encompassed by this phrase. Applicants submit that not only are the claims' metes and bounds clear on their face, but that in light of the specification, particularly page 5, lines 7–28, a person of skill in the art would understand that the term "portion" indicates it is not necessary to detect the entire stream. It is not necessary to narrow this term by reciting a quantity of neutrons measured. Applicants submit that this phrase should be given its broadest meaning and remind the Examiner that breadth is not indefiniteness. *See*, M.P.E.P. § 2173.04.

The Office action also contends that a lack of antecedent basis for certain claim terms renders claims 16, 19, 25, 29, 33 and 42 indefinite. Applicants disagree with this contention. A claim should be rejected as indefinite for lack of antecedent basis only when the lack of antecedent basis renders the claim unclear. *See*, M.P.E.P. § 2173.05(e). Moreover, a feature

does not lack antecedent basis when the feature is an inherent feature of a claim element. *See, Bose Corp. v. JBL. Inc.*, 274 F.3d 1354, 1359 (Fed. Cir. 2001)(holding that "ellipse" provided antecedent basis for its inherent feature "a major diameter"). Similarly, claim 33, recites "the spatial location" of a target. The term spatial location does not lack antecedent basis because every target inherently has a spatial location. Nonetheless, solely to expedite prosecution, applicants have amended claims 16, 19, 25, 29 and 33 as reflected in the foregoing listing of claims to provide explicit antecedent basis and the rejections of these claims should be withdrawn.

The Office action asserts that the term "upper level discriminator setting" renders claim 19 indefinite. Applicants disagree. This term is one of degree, however, the proper approach for evaluating the definiteness of such a term is to determine "whether the specification provides some standard for measuring that degree." M.P.E.P. § 2173.05(b). Because the specification does provide such a standard and provides considerable guidance, in for example, Figs. 6b and 6c, to a person of ordinary skill in the art in evaluating the upper level discriminator setting, this term does not render claim 19 indefinite.

The Office action states that there is insufficient antecedent basis in claim 42 for "a vehicle with an extension arm." Applicants respectfully request that Examiner Palabrida clarify the nature of the alleged indefiniteness as there appears to be no lack of antecedent basis for this term.

The Office action alleges that claims 44–46 are rendered indefinite by the recited feature "at least about 70 ns." Applicants disagree. As is explained by M.P.E.P. 2173.05(b), the term "about" is not indefinite where, as in this case, infringement could clearly be assessed by timing the event (citing *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540 (Fed. Cir.

1983)(holding that infringement could be assessed through use of a stopwatch). The term "at least" merely indicates that about 70 ns is the lower limit for the time delay. Although the term "at least about" was held to be indefinite in one instance (*Amgen Inc. v. Chugai Pharmaceutical Co.*, 927 F.2d 1200 (Fed. Cir. 1991)), this term is not ordinarily indefinite. In *Amgen*, there was nothing in the specification to indicate the range covered by the term "about." In contrast, applicants' specification provides considerable guidance to one of skill in the art as to how to select a suitable time delay for measuring backscattered neutrons in, for example, FIG. 7g, which charts detection efficiency as a function of the time delay. Finally, applicants note that there are, as of March 6, 2006, over 62,000 issued patents with claims that recite the phrase "at least about." Therefore the term "at least about" appears to be only rarely indefinite.

Applicants respectfully request that the rejections of claims 16–20, 22, 25–34, 36, 37 and 39–46 under 35 U.S.C. § 112, second paragraph as allegedly being indefinite be withdrawn in view of the foregoing remarks and amendments.

III. Rejections Under 35 U.S.C. § 102

Claims 16–20 22, 25–33 and 43 are rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by U.S. Patent No. 4,864,142 to Gomberg (Gomberg) or by U.S. Patent No. 5,200,626 to Schultz (Schultz). Applicants traverse this rejection and request that it be withdrawn because Gomberg and Schultz fail, independently or in combination, to teach or suggest all of the features of the pending claims.

A. *Rejections over Gomberg*

Gomberg fails to teach or suggest detecting neutrons following a time delay as recited in independent claims 16, 25 and 29. Accordingly, Gomberg also fails to teach or suggest detecting hydrogenous material, because such material is indicated by neutrons that are backscattered after a time delay. In fact, Gomberg specifically excludes the detection of neutrons backscattered after a time delay and hence does not detect hydrogenous materials. For example, Gomberg specifically describes the emission of nanosecond bursts and constraining detection to the time required for round trip travel of fast neutrons. *See*, Gomberg, column 11, line 35–40 (stating "the detector 20 is energized in synchrony so as to detect only those neutrons in a particular burst and having a transit time equal to the interval required to travel from the source to the object 22 being interrogated and back to the detector.").

Instead of detecting hydrogenous materials, Gomberg is directed to detecting scattering from elemental nuclei, specifically carbon, nitrogen, oxygen, sulfur, potassium and beryllium. Gomberg, column 6, line 58–column 7, line 10. The nuclei being detected by Gomberg all are significantly heavier than a neutron. As a result, a neutron colliding with these nuclei can be directly backscattered without significant loss of speed. Thus, the time scale for detecting such nuclei is the round-trip travel time for fast neutrons.

In contrast, the pending claims are directed to "detecting hydrogenous materials" only "after a time delay." Because hydrogen has a similar mass as a neutron, multiple scattering events must occur. Because the neutrons backscattered by hydrogen have been slowed and have undergone multiple scattering events, detection of these neutrons occurs later than neutrons backscattered by heavier elements, such as those analyzed by Gomberg.

Because Gomberg fails to teach or suggest each feature of independent claims 16, 25 and 29, applicants respectfully request that the rejection of these claims, as well as dependent claims 17–20, 22, 30–33 and 43, over Gomberg under 35 U.S.C. § 102(b) be withdrawn. Moreover, dependent claims 17–20, 22, 30–33 and 43 recite further patentable features and combinations of features and should be allowed for these reasons as well.

For example, the Office action states as to claims 17, 26 and 30 that measuring only in a window and disabling the neutron sensor after the window are inherent features of time of flight measurement. Applicants disagree. Time of flight measurement need not be limited to only a window of detection and need not require disabling the neutron sensor.

The Office action states as to claims 18, 19, 27, 31 and 32 that Gomberg's method inherently includes an upper level discriminator excluding energies or amplitudes higher than those for detecting neutrons backscattered by hydrogen. This is incorrect. Gomberg is directed to detecting neutrons backscattered by heavier elements and thus such an upper level discriminator would destroy Gomberg's intended purpose.

The Office action states as to claim 25 that Gomberg discriminates against detecting fast neutrons not scattered from hydrogenous target materials and cites Gomberg's column 11, lines 40+ in support. This is an incorrect reading of Gomberg. Gomberg excludes the detection of neutrons backscattered after a time delay because Gomberg is directed to detecting scattering from relatively heavy elements, such as carbon, nitrogen, oxygen, sulfur, potassium and beryllium (Gomberg, column 6, line 58–column 7, line 10). Thus, Gomberg does not discriminate against fast neutrons not scattered from hydrogenous materials as recited in claim 25 because Gomberg is directed to detecting exactly that type of neutrons.

Claims 34 and 42 are rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by Gomberg. Applicants traverse these rejections and request that they be withdrawn because Gomberg fails to teach or suggest all of the features of claims 34 and 42. Specifically, Gomberg fails to teach or suggest detecting hydrogenous materials or detecting neutrons following a time delay as recited in claim 29, from which claims 34 and 42 depend. Accordingly, Gomberg also fails to teach or suggest the combination of features embodied by claims 34 and 42, such as the combination of a collimator with measuring neutrons after a time delay or the combination of supporting a sensing head away from a vehicle with an extension arm. Therefore applicants respectfully request that the rejections of claims 34 and 42 under 35 U.S.C. § 102(b) over Gomberg be withdrawn.

B. Rejections over Schultz

Schultz not only fails to teach or suggest measuring backscattered neutrons but also fails to teach or suggest employing a time delay for such a measurement as is recited in independent claims 16, 25 and 29. The Office action incorrectly asserts that Schultz teaches measuring after a time delay, citing Schultz at column 8, lines 50+ and column 9, lines 19+. However, the cited portion of column 8 addresses "employing time-coincidence detection techniques" to obtain a "nitrogen density image." Thus, hydrogen backscattered neutrons are not being detected as would be after applicants' time delay. Moreover, the cited section of column 9 demonstrates that Schultz fails to detect backscattered neutrons, which have slowed due to multiple scattering events with hydrogen. As is discussed in column 9 and illustrated in Schultz's Fig. 4, the "array 40a of such neutron detectors positioned opposite the pulsed neutron generator 34" and the "[f]ast neutron detectors 40b and 40c positioned, for example on the chamber sides receive

neutrons scattered from hydrogen." Schultz, column 9, lines 12–22. Thus, Schultz does not teach the detection of backscattered neutrons.

Instead of detecting hydrogenous materials, Schultz is primarily directed to detecting heavier nuclei, such as nitrogen and oxygen. Schultz mentions "hydrogen density imaging" at column 3, line 58. However, Schultz states "[a]rrays of position-sensitive detectors on up to all six sides of the detection chamber detect fast neutrons after they have interrogated the package to form a high-resolution hydrogen density image." Schultz, column 3, lines 64–68 (emphasis added). Thus, Schultz would fail to detect backscattered neutrons, which have slowed due to multiple scattering events with hydrogen.

Schultz not only fails to teach or suggest measuring backscattered neutrons as recited in applicants' claims, but also fails to teach employing a time delay for such a measurement. Because Schultz fails to teach several elements of independent claims 16, 25 and 29, applicants respectfully request that the rejection of these claims and their dependents, *i.e.*, claims 16–20 22, 25–33 and 43 over Schultz under 35 U.S.C. § 102(b) be withdrawn. Moreover, claims 16–20 22, 25–33 and 43 also are patentable in view of additional patentable features and combinations of features recited in those claims.

For example, the Office action states as to claims 17, 26 and 30 that measuring only in a window and disabling the neutron sensor after the window are inherent features of Schultz's "time coincidence techniques." Applicants disagree. There does not appear to be any teaching or suggestion that measuring only in a window or disabling the neutron sensor thereafter are necessary or even an optional component of Schultz's time coincidence techniques.

The Office action states as to claims 18, 19, 27, 31 and 32 that Schultz method inherently includes an upper level discriminator excluding energies or amplitudes higher than those for

detecting neutrons backscattered by hydrogen. Applicants disagree. Schultz does not detect neutrons backscattered from hydrogen thus Schultz's definition of an "appropriately programmed computer" would have no need to account for the thermalized neutrons detected according to the method of claims 18, 19, 27, 31 and 32.

The Office action states as to claim 25 that Schultz method discriminates against detecting fast neutrons, and cites Schultz's neutron detectors 40b and 40c in support for this proposition. This is incorrect. As stated by Schultz, "[f]ast neutron detectors **40b** and **40c** positioned, for example on the chamber sides receive neutrons scattered from hydrogen." Schultz, column 9, lines 12–22 (emphasis added). Thus, Schultz does not discriminate against fast neutrons, but rather detects fast neutrons.

Claims 36, 37, 39 and 40 are rejected under 35 U.S.C. § 102(b) as allegedly being anticipated by Schultz. Applicants traverse these rejections and request that they be withdrawn. These claims are allowable for at least the reason that Schultz fails to teach or suggest all of the features of claim 29 from which claims 36, 37, 39 and 40 directly or indirectly depend. These claims are further allowable over Schultz in view of the additional patentable features and combinations of features recited therein. Applicants therefore respectfully request that the rejections of claims 36, 37, 39 and 40 under 35 U.S.C. § 102(b) over Schultz be withdrawn.

IV. Rejections Under 35 U.S.C. § 103

Claim 41 is rejected under 35 U.S.C. § 103 as allegedly being unpatentable over Gomberg or Schultz in view of either U.S. Patent No. 3,577,158 to Hahn (Hahn) or 5,083,029 to Buchanan (Buchanan). Applicants traverse this rejection and request that it be withdrawn.

The Office action relies on Hahn and Buchanan to cure the failure of Gomberg and Schultz to teach using a neutron shield comprising ^{10}B . Even if, assuming solely for the purpose of argument, that Hahn and/or Buchanan teach this feature and are properly combinable with Gomberg or Schultz, the proposed combination still fails to teach or suggest all of the elements recited in Applicants' claims. Neither Hahn nor Buchanan can cure the deficiencies of Gomberg and Schultz to teach or suggest measuring backscattered neutrons after a time delay. Therefore, none of the proposed combinations teach or suggest each feature of applicant's claims as required by 35 U.S.C. § 103 and M.P.E.P. § 2143.03. Accordingly, applicants respectfully request that the rejection of claim 41 under 35 U.S.C. § 103 be withdrawn.

Claims 44–46 are rejected under 35 U.S.C. § 103(b) as allegedly being unpatentable over either Gomberg or Schultz. Applicants traverse these rejections and request that they be withdrawn because the Office action fails to establish a *prima facie* case of obviousness.

To establish *prima facie* obviousness, all claim limitations must be taught or suggested by the prior art. M.P.E.P. § 2143.03. Neither Gomberg nor Schultz teach or suggest all of the features of claims 44–46. Specifically, Gomberg and Schultz fail to teach or suggest measuring neutrons after a time delay and hence also fail to teach the specific time delays recited in claims 44–46. Moreover, there is no suggestion or motivation present in either Gomberg or Schultz to even include a time delay in their measuring protocols. As is explained by the present specification, the time delay is used so that neutrons backscattered by hydrogenous materials are detected. Because neither Schultz nor Gomberg is directed to detecting neutrons backscattered by hydrogen, neither reference provides any suggestion or motivation to incorporate a time delay, much less the time delays recited in claims 44–46. Accordingly, a *prima facie* case of

obviousness has not been established over Gomberg and/or Schultz, and applicants respectfully request that the rejections of claims 44–46 be withdrawn.

Conclusion

Applicants submit that claims 16–20, 22, 25–34, 36, 37 and 39–46 are in condition for allowance. Such action is respectfully requested. Moreover, applicants request that withdrawn claims 21, 23, 24, 35 and 38 be reinstated and examined in the present application upon the allowance of a generic claim.

Respectfully submitted,

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